

1. (Amended) A substrate processing system, comprising:  
a vacuum chamber;  
a substrate supporter, located within the vacuum chamber, for holding a substrate;  
a gas manifold for introducing process gases into the chamber;  
a gas distribution system, coupled to the gas manifold, for distributing the process gases to the gas manifold from gas sources;  
a power supply coupled between the substrate supporter and the gas manifold;  
a vacuum system for controlling pressure within the vacuum chamber;  
a controller, including a computer, for controlling the gas distribution system, the power supply and the vacuum system; and  
a memory coupled to the controller comprising a computer [usable] readable medium having a computer readable program code embodied therein for directing operation of the substrate processing system, the computer readable program code including:  
computer readable program code for causing the gas distribution system to introduce a first process gas comprising a mixture of  $\text{SiH}_4$  and  $\text{N}_2\text{O}$  into the chamber to deposit a first plasma enhanced CVD layer over the wafer; and  
computer readable program code for causing the gas distribution system to introduce a second process gas comprising He into the chamber to control the deposition rate of the first layer.

2. A substrate processing system as in claim 1 wherein the computer readable program code for causing the gas distribution system to introduce the first process gas comprising a mixture of  $\text{SiH}_4$  and  $\text{N}_2\text{O}$  into the chamber controls the introduction of the  $\text{SiH}_4$  to be between 5 to 300 sccm, and the rate of  $\text{N}_2\text{O}$  to be between 5 to 300 sccm.

3. A substrate processing system as in claim 2 wherein the computer readable program code for causing the gas distribution system to introduce a second process gas comprising He into the chamber controls the chamber pressure at about 1 to 6 torr.

1                   4.     A substrate processing system as in claim 3 wherein the computer  
2 readable program code for causing the gas distribution system to introduce the first process gas  
3 comprising a mixture of  $\text{SiH}_4$  and  $\text{N}_2\text{O}$  into the chamber controls the introduction of the  $\text{SiH}_4$  to  
4 be at a ratio of between 0.5 to 3 times the amount of  $\text{N}_2\text{O}$ .

1                   5.     A substrate processing system as in claim 1 further comprising:  
2 computer readable program code for causing the gas distribution system to  
3 introduce a third process gas comprising  $\text{NH}_3$  into the chamber; and  
4 computer readable program code for causing the gas distribution system to  
5 introduce a fourth process gas comprising  $\text{N}_2$  into the chamber.

1                   6.     A substrate processing system as in claim 5 wherein:  
2 the computer readable program code for causing the gas distribution system to  
3 introduce a third process gas comprising  $\text{NH}_3$  into the chamber controls the introduction of the  
4  $\text{NH}_3$  to be between a rate of 0 to 300 sccm; and  
5 the computer readable program code for causing the gas distribution system to  
6 introduce a fourth process gas comprising  $\text{N}_2$  into the chamber controls the introduction of the  
7  $\text{N}_2$  to be between a rate of 0 to 4000 sccm.

1                   7.     A substrate processing system as in claim 1 further comprising computer  
2 readable program code for controlling the gas distribution system to operate for a specified  
3 time period.

1                   8.     A substrate processing system as in claim 7 wherein the computer  
2 readable program code for controlling the gas distribution system to operate for a specified  
3 time period comprises computer readable program code for causing the first plasma enhanced  
4 CVD layer to be formed to a thickness which is an odd multiple, greater than one, of a  
5 wavelength of light to be used in a subsequent process operation on the layer.

1                   9.     A substrate processing system as in claim 2 wherein the computer  
2 readable program code for causing the gas distribution system to introduce the first process gas

3 comprising a mixture of  $\text{SiH}_4$  and  $\text{N}_2\text{O}$  into the chamber controls the introduction of the  $\text{SiH}_4$  to  
4 be between 15 to 160 sccm, and the rate of  $\text{N}_2\text{O}$  to be between a rate of 15 to 160 sccm.

1 10. A substrate processing system as in claim 9 further comprising:  
2 computer readable program code for causing the gas distribution system to  
3 introduce a third process gas comprising  $\text{NH}_3$  into the chamber at a rate of less than 150 sccm;  
4 and  
5 computer readable program code for causing the gas distribution system to  
6 introduce a fourth process gas comprising  $\text{N}_2$  into the chamber at a rate of less than 300 sccm.

1 44. (New) A substrate processing system, comprising:  
2 a process chamber;  
3 a substrate support, located within the vacuum chamber, for supporting a  
4 substrate;  
5 a power supply;  
6 a gas delivery system for delivering process gases into the process chamber;  
7 a controller configured to control the power supply and the gas delivery system;  
8 and  
9 a memory coupled to the controller comprising a computer readable medium  
10 having a computer readable program embodied therein for directing operation of the substrate  
11 processing system, the computer readable program including a first set of computer  
12 instructions for controlling the gas delivery system to introduce selected deposition gases into  
13 the process chamber at deposited gas flow rates, a second set of computer instructions for  
14 controlling the gas delivery system to add a flow of an inert gas to the selected deposition  
15 gases at a flow rate previously determined to achieve a desired low deposition rate from a  
16 plasma enhanced reaction of the selected deposition gases, the desired low deposition rate  
17 being lower than a deposition rate using the selected deposition gases at the deposition gas  
18 flow rates with a lower flow rate of the inert gas, and a third set of computer instructions for  
19 controlling the power supply to supply power to the process chamber to produce a plasma  
20 enhanced reaction of the deposition gases in the process chamber to deposit a film at the low  
21 deposition rate.

1 45. (New) The substrate processing system of claim 44 wherein the inert  
2 gas comprises helium.

1 46. (New) The substrate processing system of claim 44 wherein the selected  
2 deposition gases comprise silane and an oxygen source.

1 47. (New) The substrate processing system of claim 44 wherein the selected  
2 deposition gases comprise silane and nitrous oxide.

1 48. (New) The substrate processing system of claim 44 wherein the selected  
2 deposition gases comprise silane and a nitrogen source.

1 49. (New) The substrate processing system of claim 44 further comprising a  
2 vacuum system for controlling pressure within the process chamber, and wherein the  
3 computer-readable program further comprises a fourth set of computer instructions for  
4 controlling the vacuum system to maintain a chamber pressure in the range of 1-6 Torr, and  
5 wherein the selected deposition gases comprise  $\text{SiH}_4$  flowed into the chamber at a rate of 5-300  
6 sccm and  $\text{N}_2\text{O}$  flowed into the chamber at a rate of 5-300 sccm.

1 50. (New) The substrate processing system of claim 49 further comprising a  
2 heater for heating the substrate, and wherein the computer-readable program further comprises  
3 a fifth set of computer instructions for controlling the heater to heat the substrate to a  
4 temperature in the range of 200-400°C.

1 51. (New) The substrate processing system of claim 50 wherein the  
2 substrate support is spaced from the gas distribution system at a distance in the range of 200-  
3 600 mils.

1 52. (New) The substrate processing system of claim 49 wherein the selected  
2 deposition gases further comprise  $\text{NH}_3$  flowed into the chamber at a rate of less than 300 sccm,  
3 and  $\text{N}_2$  flowed into the chamber at a rate of less than 4000 sccm.

1 53. (New) A substrate processing system, comprising:  
2 a process chamber;

3 a substrate support, located within the vacuum chamber, for supporting a  
4 substrate;  
5 an RF power supply;  
6 a heater;  
7 a gas delivery system for delivering process gases into the process chamber;  
8 a controller configured to control the power supply and the gas delivery system;  
9 and  
10 a memory coupled to the controller comprising a computer readable medium  
11 having a computer readable program embodied therein for directing operation of the substrate  
12 processing system, the computer readable program including a first set of computer  
13 instructions for controlling the gas delivery system to flow He into the process chamber at a  
14 selected flow rate to provide a chamber pressure in the range of 1-6 Torr, a second set of  
15 computer instructions for controlling the RF power supply to supply power of 50-500 Watts to  
16 the process chamber, a third set of computer instructions for controlling the heater to heat the  
17 substrate to a temperature in the range of 200-400°C, a fourth set of computer instructions for  
18 controlling the gas delivery system to flow SiH<sub>4</sub> at a flow rate of 5-300 sccm into the process  
19 chamber, and a fifth set of computer instructions to flow N<sub>2</sub>O at a flow rate of 5-300 sccm into  
20 the process chamber, wherein a ratio of the selected flow rate of He to the combined flow rate  
21 of SiH<sub>4</sub> and N<sub>2</sub>O is at least 6.25:1 to deposit an antireflective layer on the substrate at a  
22 deposition rate which is lower than a deposition rate using the same flow rate of SiH<sub>4</sub> and the  
23 same flow rate of N<sub>2</sub>O with a lower flow rate of He.

1 54. (New) A substrate processing system, comprising:  
2 a process chamber;  
3 a substrate support, located within the vacuum chamber, for supporting a  
4 substrate;  
5 a power supply;  
6 a gas delivery system for delivering process gases into the process chamber;  
7 a controller configured to control the power supply and the gas delivery system;  
8 and